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## REFORESTATION AT WOODS HOLE, MASSACHUSETTS.—A STUDY IN SUCCESSION.<sup>1</sup>

MINTIN ASBURY CHRYSLER.

(Plates 62, 63.)

ALTHOUGH the principle known as succession in plant societies is supported by convincing evidence, it does not frequently happen that the process occurs with sufficient rapidity to pass through one or more cycles within the period of one man's observations. Further, because of the newness of the dynamic point of view, records of a kind valuable to the ecologist are not numerous. It is also true that in this country few experiments in forestation have been made. The tract of forest known as Fay's Woods near the village of Woods Hole, Massachusetts, presents, however, a remarkably good example of quick succession of vegetation, aided by artificial planting.

The area in question lies between Buzzards Bay and Vineyard Sound at the southwestern extremity of Cape Cod, comprising about four hundred acres now largely covered with a mixture of pines and deciduous trees. As may be seen from plate 63, fig. 1, the land rises rather abruptly from the sea, and there are abundant evidences to show that the area forms a terminal moraine. Boulders of all sizes are plentiful, and the surface of the tract is particularly uneven owing to the presence of numerous ravines and "kettle holes," as described by Shaw.<sup>2</sup> The general height of the forested area is sixty feet above the sea.

<sup>1</sup> This investigation was conducted at the Marine Biological Laboratory, Woods Hole, during the summer of 1903 and 1904. I am indebted for many helpful suggestions to Miss Sarah B. Fay and Prof. Bradley M. Davis.

<sup>2</sup> Bot. Gazette 33: 437-450. 1902.



This area is known to have been treeless in 1850, except the ravines in the northern (inland) part of the estate. It is natural to inquire whether this condition existed during the early days of colonization of the region. Gosnold says that the pilgrims in 1620 found Cape Cod harbor "compassed about to the very sea with oaks, pines, juniper, sassafras, and other sweet wood,"<sup>1</sup> also that the island now known as Nonamesset (across the channel from Woods Hole) was "full of wood, vines, and berries."<sup>2</sup> It is known that the neighboring island of Nantucket<sup>3</sup> was in 1661 well provided with forests of oak, walnut, beech, pine and cedar, and that these were largely destroyed by cutting and by the sheep and goats which were so extensively reared on the island; in 1665 there were forty-eight owners of herds and flocks on this island alone. Most of the people who settled Nantucket came from the mainland and probably transferred the herding industry to their new home. The climatic conditions on the peninsula of Cape Cod are certainly no more severe than those on the island of Nantucket, so it is pretty safe to infer that the region about Woods Hole was well forested three hundred years ago, and destroyed by cutting and grazing, despite the impression which is prevalent in that neighborhood to the effect that the region was naturally treeless.

Undoubtedly the conditions in this area are at present unfavorable for tree growth, chiefly because the area is well drained owing to slope and nature of the soil, and perhaps because of the salt winds which almost constantly blow either from Vineyard Sound or Buzzards Bay. Hence natural reforestation is exceedingly slow. Nature's unaided efforts are shown in the tract lying between the forested area on one hand and Buzzards Bay and Quisset Harbor on the other. This area known as Ganset has lain undisturbed for at least sixty years and probably much longer. The plant covering is mainly herbaceous, with scattered clumps of stunted shrubs, and here and there solitary specimens of *Juniperus virginiana* 4-8 feet high. The herbaceous plants are moderately xerophytic in nature, being chiefly *Cladonia rangiferina*, *Polytrichum commune*, *Lechea* sp., *Hypericum perforatum*, *Trifolium pratense*, *Potentilla canadensis*, *Achillea millefolium*, *Chrysanthemum Leucanthemum*, var. *subpinnati*

<sup>1</sup> Quoted in Freeman, F., History of Cape Cod, page 62.

<sup>2</sup> Ibid., page 30.

<sup>3</sup> W. R. Bliss, Quaint Nantucket. Boston, 1896.

*fidum*,<sup>1</sup> *Poa* spp., *Sisyrinchium angustifolium*. The clumps of shrubs consist of *Myrica carolinensis* (*cerifera* of New England) and a dwarf form of *Rhus copallina* with which *Rubus villosus*<sup>2</sup> is sometimes associated. The boundary between this area and the adjoining planted tract is pretty clearly marked, though young specimens of *Pinus sylvestris* and *P. rigida* are frequent near the line and a few specimens are scattered through the open area. These young trees have undoubtedly sprung from seed which has blown from the planted tract.

In 1850 the whole area under consideration was more barren than the portion just described. Plate 62, fig. 1, which is a pen copy by Prof. Davis from a water-color owned by Miss Fay, gives an idea of the bareness of the region at that time. Fig. 2 shows the aspect of the same region in 1897. The striking change in the plant covering of the region has been partly brought about through the efforts of the late Mr. J. S. Fay. But he had better tell his own story; the following is an extract from an address delivered by him in Boston in 1878:


"I will come now to my own experience, which is perhaps what you most want to hear, but which can be briefly stated. In 1851 I took possession of a place which I had purchased at Woods Holl, at the southwestern extremity of Cape Cod, on a peninsula between Vineyard Sound on the south and Buzzards Bay on the north, to the shores of both which my land extended. My house was prettily situated with regard to the water, fronting south, standing above Little Harbor, so called, and looking upon and over the Sound. In the rear, to the northward, the land rose gradually but not far, till it reached a ridge or series of bare hills, running parallel to and overlooking the Sound. Over and behind these, on the north slope and in a valley, unseen from the water on the south, were about twenty-five acres of natural growth of oak, hickory, beech and hop horn-beam, with a few pepperedge and red maples on the borders of a swamp. In sight of my house, about the harbor, and on the road, however, and indeed in all the village, there was not a single tree to be seen (except three Balm of Gileads), nor was there a single ever-green, on my whole place.

<sup>1</sup> See RHODORA 5: 181. 1903.

<sup>2</sup> As defined by Bailey, Evolution of Native Fruits, 371.



I began in the spring of 1852 to plant a variety of trees for ornament, but as may be supposed, at fifty cents each from nurserymen, a very extensive planting would have been quite costly. I therefore, at the suggestion of my brother, Richard S. Fay, of Lynn, imported from England about 20,000 seedlings, comprising Scotch larches, and birches, Austrian and Scotch pines, English oaks and sycamores, and Norway spruces. They came through the voyage well, and I placed them in a nursery, where they thrived. About the same time, I began to transplant the native white and pitch pines from the old fields in the eastern part of the town (Falmouth) and to cover with them the bare gravelly hills in the rear of my house and fronting the water. After the imported trees had been cultivated in the nursery two years, I transplanted them and mixed them with the native pines, and also placed them in the vacant spots and openings, and on the outskirts of a twenty-five acre wood lot back of my house. They all did well. Beyond this wood lot, I had nearly 200 acres of old pasture and arable land (not much of the latter) stretching away northward to Buzzards Bay, on which there was not a tree large enough to give shade to a rabbit. Upon the sixty acres nearest home which I reserved for pasture, I planted half acre clumps of the imported trees, surrounding them with cheap fences of wire, drawn through posts, to keep off the cattle, until they should grow large enough for shade. Most of these trees are now of good size, and are doing well. About my house, where formerly there was not a tree, and where my neighbors said I could not make them grow, right in the face of the salt bearing southerly gales, the hills are covered with large pines, spruces, and other trees, and my buildings seem rather to have been planted in a grove, than that the grove should have been brought to them. And yet I have already cut away many trees, because they are too crowded. But after all this planting with the spade, I had upwards of a hundred acres of very poor pasture land, still bare of trees, and for which I had no use. It was overgrown in many places with patches of bushes, and much of the grass had given way to moss. It occurred to me that the easiest and cheapest way to utilize and improve this tract, would be to plant it with the seeds of trees and leave it to take care of itself. As there were no evergreens in the neighborhood, except those which I had set out near home, and as the Scotch and Austrian pines and Norway spruce seemed to stand the sea air well, I concluded to sow



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FIG. 1. KRUMMHOLZ ON BUZZARDS BAY.



FIG. 2. OAKS REPLACING SCOTCH PINES.



these varieties which I imported, mixing them with the seeds of the native sorts. I began in 1861 to scatter them broadcast on the sward, without any care or system, and continued it for three or four years, and now I have a stretch of nearly one hundred acres covered with a dense growth of evergreen trees, giving pleasure to the eye and the promise of great usefulness."

If one now walks through the woods with this description written in 1878 in hand, he readily sees that in the course of twenty-five years a considerable change has come over the face of the landscape, now characterized mainly by the presence of many deciduous trees mixed with the evergreens and in many places outnumbering the latter. Moreover, the older Scotch pines present a sickly appearance, having many bare branches, though young specimens look particularly vigorous. Plate 63, fig. 2, represents an elevated spot near Buzzards Bay, in the tract mentioned as planted subsequent to 1861. Most of the trees in the background are *Pinus sylvestris*; it will be noticed that the oldest ones look decidedly unhealthy. Some dead specimens have been cut out in the foreground. The seedlings which have grown up under the shelter of the pines are here as in all parts of the woods *Quercus tinctoria* and *Q. alba*, with a few *Pinus sylvestris*. The spot pictured is not quite typical of the whole woods, for it was chosen on account of the open character of the vegetation. Usually the oaks are considerably larger, and with them are hickory, white and pitch pine, maple, all in smaller numbers than the oaks. The shrubs not clearly shown in the photograph are *Rhus copallina*, *Myrica carolinensis* and *Rubus villosus*, which may be regarded as relicts, and *Prunus serotina*, *Amelanchier canadensis*, *Rhus toxicodendron*, *Corylus rostrata*, *Viburnum dentatum*, which accompany the deciduous trees in the mesotrophic development of the flora, and hence may be called pioneers.

The various parts of this piece of woodland present quite different appearances on account of (1) the differences in planting, as well as of (2) physical conditions such as drainage. Several areas on which English larch predominates illustrate the first conditions; these trees have been planted to replace the pines, and have suffered from the ravages of an insect which destroys the leaves. In other parts English white oak (*Q. robur*), white pine, Austrian pine, spruce, catalpa, sycamore maple, Norway maple, and locust (*Robinia pseud-acacia*) are more or less prominent. Areas illustrating the second

condition are characterized by beeches and *Chamaecyparis* which have spread from low-lying tracts; the latter tree is dominant in certain swamps, as described by Shaw (l. c.).

In order to test the application of principles of succession to the area in question it is necessary to know just which species have been planted artificially, and which have come in naturally. Accurate information has been obtained from Miss Sarah B. Fay and Mr. M. H. Walsh, who have witnessed many of the changes already described. Evidently the European forms were introduced, *viz.*, Scotch and Austrian pines, larch, Norway spruce, English oak, sycamore maple, and the same is true of the older pitch and white pines, according to Mr. Fay's manuscript. Some of the trees represent the original planting, while others, *e. g.*, the group of larch, have been set out to replace the defunct Scotch pines, while most of the young pines have sprung up from seed produced by the older trees. It has been ascertained that none of the oaks were planted,—a point of some significance. The beeches, hop hornbeam, tupelo, and all the shrubs have appeared naturally. Apparently most of the hickory has been planted, though the tree commonly occurs in sheltered places in the region. It appears then that this forest has by the aid of man quickly passed into and through the *pine* stage, and is now in the early part of the *oak* stage. There are but few signs of its passing into the *oak-hickory* stage, much less of its being in the *maple-beech* stage, which is regarded by Cowles as the climatic climax forest of the region. Probably the climatic conditions are such that the area in question may never see this climatic climax, although in a moderately sheltered situation in the northeastern part of the adjacent island of Naushon there occurs a fine beech forest.

The principal factor which has brought about the changes described seems to have been the short life of the Scotch pine; but why should its life be so much shorter in Massachusetts than in Scotland? It has been suggested that a borer is responsible; also that the soil "gave out" in the planted areas. This view is negated by the observation that young specimens show a vigorous growth in the immediate neighborhood of the old and dying trees. Probably some undetermined feature of the climate here renders the trees short lived. The salt-laden winds would naturally have more effect on the trees as they grew taller. This idea is borne out by Mr. Fay's experiments in planting hickory trees, which were found to

come up quickly and to thrive until they raised their heads above the general level of the forest; then it seemed that the salt winds struck them and they soon showed signs of decay.

Concerning the rapid appearance of seedlings of deciduous trees, especially oaks, the source is sufficiently indicated by Mr. Fay's reference to the natural grove in the valley near the house, and no doubt other depressions also contained trees. It is always difficult to understand how a heavy seed such as an acorn can be so rapidly dispersed; in the present case Mr. Fay always claimed that the squirrels and blue jays were responsible; the latter have for a long time been plentiful in the region. Once germinated the very tolerant oak seedlings could afford to bide their time, which soon came in this instance on account of the short life of the Scotch pines. Severe storms such as that which occurred in 1898 have no doubt blown down many pines and thus formed openings which oaks have quickly filled up.

#### THE KRUMMHOLZ.

On the Buzzards Bay shore occurs a rather remarkable formation which illustrates the action of certain factors already referred to. As shown in plate 63, fig. 1, the land rises abruptly from a strand covered with boulders, then descends, and further inland rises gradually to the general level of the wooded tract. Nearest to the strand the only plants are *Lathyrus maritimus* and *Ligusticum Scoticum*—two characteristic halophytes of the region, *Poa* sp., *Trifolium arvense*, *Lechea* sp. A little higher up *Myrica carolinensis* is associated with these and clumps of this are seen in the left of the picture. Near the top of the slope appear dwarf specimens of Scotch pine, the ones nearest the water being smallest, their height gradually and regularly increasing on the inland part of the tract though the surface of the ground here descends, as stated earlier. The trees composing this formation are gnarled and twisted into fantastic shapes, and are so closely set that they form an impenetrable thicket. The level of the top of the trees is so regular that it gives one the impression that some giant has trimmed the trees with his scythe. Although *Pinus sylvestris* forms the bulk of the formation, there is a small proportion of *P. rigida* and *P. austriaca*, and a few specimens of *Juniperus virginiana* and of *Rhus copallina* are scattered through



the tangle. The term *krummholz* (literally "crooked wood") is usually applied to a mountain formation,<sup>1</sup> but the characters are so perfectly reproduced in the present instance that the application of the term may with profit be extended. The cause for this stunting of the trees is probably to be sought in the mechanical and drying action of the wind. The prevailing winds at Woods Hole are from the southwest; these would exert their full effect on the area in question, for it faces the west and is bounded on the south by a bay whose shore owing to wave action is littered with boulders. The mechanical action of the wind causes the greater development of branches on the east (leeward) side of a tree and the pronounced leaning of the trees in that direction; marked examples of this action are also to be seen on the neighboring island of Naushon. What has been referred to as the drying action of the wind causes a high rate of transpiration, *i. e.*, high compared with absorption; this results in a general dwarfing of the tree and in the death of some of the branches. It may be urged that a sea-breeze is damp rather than dry, and undoubtedly this is the case at times; but ordinarily the moving air is less nearly saturated than air which is stationary around a transpiring leaf. The action of salt present in the wind is certainly not the primary factor, for a *krummholz* can be formed in places far removed from the sea, but the harmful influence of salt on most vegetation is so certain that it probably has some influence here. It is reported that trees a mile inland on the island of Martha's Vineyard become incrustated with salt during winter storms. That the wind is the chief agent in producing the *krummholz* seems exceedingly probable from the mowed-off appearance of the "surface" of the formation.

#### CONCLUSION.

It has been the writer's attempt in this short account to show that the agency of man may accelerate the process called succession. The exposed nature of the area under consideration would have rendered the progression from a heath to a forest a slow one, but through the artificial introduction of conifers and by reason of the short life of these trees a second stage in reforestation, *viz.*, domi-

<sup>1</sup> Schimper, A. F. W., *Pflanzengeog.* p. 740.

nance of oaks, has in fifty years been nearly attained. Probably the conditions are too severe to permit the eventual appearance of the climax formation (maple-beech), except in the more sheltered parts of the area. This study also shows what may be accomplished by a determined man in covering a naked area with beautiful and useful trees. The best way to utilize much of the unproductive land in this state is to plant suitable trees and treat them in accordance with the accepted principles of forestry.

HARVARD UNIVERSITY.

EXPLANATION OF PLATE 62, Fig. 1. Woods Hole about 1850, from east side of Little Harbor. Outline copy of an old water-color in the possession of Miss Sarah B. Fay. Fig. 2. Photograph taken in 1897 from the same point as in figure 1.

PLATE 63, Fig. 1. Krummholz on shore of Buzzards Bay, viewed from the south. Fig. 2. A rather open part of the forest, showing the unhealthy Scotch pines, and young oaks replacing them.

## THE NORTH AMERICAN SPECIES OF *ERIOPHORUM*.

M. L. FERNALD.

### *PART 2. NOTES ON THE PRECEDING SYNOPSIS.*<sup>1</sup>

#### GENERIC STATUS OF *ERIOPHORUM*.

LINNAEUS, in first defining the genus *Eriophorum*,<sup>2</sup> referred to a figure of Micheli's *Linagrostis*.<sup>3</sup> This figure, although a conventionalized drawing, represents an ovoid spikelet with very numerous scales, and dissections of the spikelet, showing a perianth of numerous bristles. From this old figure one may safely infer that the original *Eriophorum* as interpreted by Linnaeus in his *Genera Plantarum* was a plant very near if not the European *E. vaginatum*. Later, in the *Species Plantarum*,<sup>4</sup> Linnaeus distinguished four species of *Eriophorum*, the European *E. vaginatum* and *E. polystachion*, the American *E. virginicum*, and the European *E. alpinum*, species which have subsequently stood as typical of *Eriophorum*, although, in 1772,

<sup>1</sup> RHODORA, vii. 81-92.

<sup>2</sup> L. Gen. 12 (1737).

<sup>3</sup> Micheli, Nov. Gen. 53, t. 31 (1729).

<sup>4</sup> L. Sp. 52, 53 (1753).

Scapoli<sup>1</sup> revived for the three European species the prelinnean generic name *Linagrostis*.

In the second edition of the *Species Plantarum*, however, Linnaeus added to his *Eriophorum*, *E. cyperinum*,<sup>2</sup> the type of a large American group of species, the Wool Grasses, whose affinities are with *Scirpus*, a fact which Linnaeus himself suspected as shown by his note: "*statura omnino Cyperi, sed Spiculæ Scirpi, nisi Semina maturescentia producerent Lanam gilvam S. testaceam, vix spiculis longiorem.*" By those systematists who have followed Linnaeus in including with the true *Eriophorums* having long straight flattened bristles, the very dissimilar *E. cyperinum* with crinkled and strongly curled terete bristles, such generic distinctions as otherwise separate the genera *Eriophorum* and *Scirpus* are obscured and the former separated from the latter merely by the perianth bristles without barbs and more or less exceeding the scales of the spikelets.

That this treatment would place the two genera upon an absurdly weak footing is well shown by three nearly related species. *Scirpus Peckii*, Britton, is habitally closely similar on the one hand to the Wool Grass, *Eriophorum lineatum*, Benth. & Hook., and on the other hand so close to the unquestioned *Scirpus*, *S. polyphyllus*, Vahl., that in his original description a specimen of the latter was confused by Dr. Britton with the Peck specimen.<sup>3</sup> Yet, *Eriophorum lineatum* has curly elongate barbless bristles which place it near *E. cyperinum*. L.; *Scirpus polyphyllus* has the bristles barbed much as in *S. atrovirens*, but usually bent or slightly curled; and *Scirpus Peckii*, with bristles elongated and curled much as in *Eriophorum lineatum*, often has a few weak barbs at the tip. These plants, obviously inseparable as genera, all have innumerable small spikelets, small appressed scales, and 6 perianth-bristles, and by many authors they are maintained as members of the genus *Scirpus*,<sup>4</sup> a course which seems rational and open to no question.

<sup>1</sup> Scop. Fl. Carn. ed. 2, i. 47 (1772).

<sup>2</sup> L. Sp. ed. 2, 77 (1762).

<sup>3</sup> See Brainerd, RHODORA, iii. 32 (1901).

<sup>4</sup> *Eriophorum japonicum*, Maxim. Bull. Acad. Sci. St.-Petersb. xxxi. III (1886 and Mém. Biol. xii. 558 (1886), in its 6 bristles somewhat scabrous at tip is clearly a *Scirpus* and a full sheet of specimens in the Gray Herbarium, collected by Charles Wright on mountain tops near the Ochotsk Sea, shows it to be related on the one hand to the *Scirpus sylvaticus* group, and on the other to *S. cyperinus* and its allies. This plant of the mountains of eastern Asia should be called *Scirpus japonicus*, n. comb.



The removal of the tall *Eriophorum cyperinum* and its numerous allies from the genus leaves what is in many ways a natural group; but as treated by Linnaeus in the first edition of the *Species Plantarum* and as ordinarily accepted, *Eriophorum* contains one species, *E. alpinum*, which, like the Wool Grasses, still leaves the genus unsatisfactorily distinguished from *Scirpus*. With the exception of this single species, *Eriophorum alpinum*, the members of the genus (with *E. cyperinum* and its allies removed to *Scirpus*) have many characteristics in common which define the group as a well marked genus. All have the membranous scales of the spikelets with spreading or loosely ascending tips, and the perianth of many slender ligulate bristles;<sup>1</sup> and in the monocephalous species, *E. vaginatum*, &c., with which *E. alpinum* has been associated, the culms are usually invested with loose often somewhat inflated membranous-tipped sheaths; the spikelets are large, of very numerous membranous or scarious spreading or spreading-ascending scales, several of the lower empty, and the outermost enlarged, 3-several-nerved and persistent.

*Eriophorum alpinum*, however, which has been very generally treated as a close ally of *E. vaginatum*, &c., but which, with *Scirpus cyperinus* and *S. lineatus*, was made by Persoon the basis of another genus, *Trichophorum*<sup>2</sup> has characteristics which separate it very clearly from *Eriophorum*. The sheaths of *Eriophorum alpinum*, confined chiefly to the base of the plant, are close and firm; the spikelets subulate-ovoid, about 5 mm. long, of few incurved-ascending chartaceous scales, the outermost of which is caducous and has its strong green costa prolonged into a blunt mucro; and the ligulate bristles are only 6 in number. In all these characteristics the plant is so closely similar to the boreal *Scirpus caespitosus*, L., and *Scirpus alpinus*, Schleicher, that more than one student of the group has commented upon the fact. Thus, in 1836, Torrey remarked that "This *Eriophorum* differs from all the other single-spiked species of the genus in the rigid scales of the spike, and in the definite crisped bristles";<sup>3</sup> and by others, as recently, in a very detailed discussion of the anatomical structure of the stems of the plants which have

<sup>1</sup> By some authors spoken of as ligulate segments of 6 deeply cleft bristles (see Clarke in Hook. Fl. Br. Ind. vi. 663).

<sup>2</sup> Persoon, Syn. i. 69 (1805).

<sup>3</sup> Torr. Ann. Lyc. Nat. Hist. N. Y. iii. 335 (1836).

passed as *Eriophorum*, by Palla<sup>1</sup> *Scirpus caespitosus* is placed with *Eriophorum alpinum* in the genus *Trichophorum*.

Limited as it was by Palla to *Trichophorum alpinum*, Pers. (*Eriophorum*, L.) and *T. caespitosum*, Schur. (*Scirpus*, L.) with barbless ligulate bristles, and *T. atrichum*, Palla (*Scirpus alpinus*, Schleicher) without bristles, *Trichophorum* would have a strong morphological basis for separation from both *Scirpus* and *Eriophorum*. In eastern North America, however, there is a plant, *Scirpus Clintonii*, Gray, which, in habit, spikelets, chartaceous scales, the outermost deciduous and with the strong green costa prolonged into a mucro, is clearly to be placed with *Trichophorum alpinum*, *T. caespitosum*, and *T. atrichum*. This plant, in its spikelets is, in fact, more like *Trichophorum* (*Eriophorum*) *alpinum* than that species is to *T.* (*Scirpus*) *caespitosum*, but its perianth-bristles are not only terete but very freely setulose. In these characteristics *Scirpus Clintonii* is close to *S. pauciflorus*, Lightf., a species which Palla very definitely excludes from *Trichophorum*.<sup>2</sup> Thus *Scirpus Clintonii* combines to such an extent the morphological characteristics of *Trichophorum* as interpreted by Palla and *Scirpus pauciflorus* which Palla regards as a *Scirpus* as to indicate that the characters upon which *Trichophorum* is maintained by him are not truly concomitant and that the genus is at best a subgenus of *Scirpus*, with close affinity to *S. pauciflorus* and *S. nanus*.

The plant which led to this discussion, *Eriophorum alpinum*, L., is, then, a species of *Scirpus* rather than of *Eriophorum* in its limited sense; but as there is already a *Scirpus alpinus*, Schleicher, it has been necessary in transferring *Eriophorum alpinum* to use a specific name which shall not duplicate Schleicher's already established combination, *Scirpus alpinus*. This was recently done by Ascherson and Graebner, and henceforth the densely caespitose *Scirpus* with elongate ligulate white bristles should be called *S. Trichophorum*, Ascherson & Graebner.<sup>3</sup>

In the paper already referred to, Palla maintains that *Eriophorum*

<sup>1</sup> Bot. Zeit. liv. ab. 1, 145, 151 (1896).

<sup>2</sup> "Hier sie auf eine unrichtige Angabe Richter's in seinen 'Plantae Europaeae,' S. 139, aufmerksam gemacht. Richter führt unter den Synonymen des *Scirpus pauciflorus* Lightf. ein *Trichophorum pauciflorum* Palla auf. Ein solches ist von mir nie aufgestellt worden." — Palla, l. c. 146.

<sup>3</sup> Asch. & Graebn. Syn. ii. ab. 2, 302 (1903).

*virginicum*, L., is an endemic American genus, *Eriophoropsis*, which he separates on characters confined strictly to the anatomical structure of the stem and leaves, himself admitting that in its fruiting characters and in its bristles the plant cannot be separated from *Eriophorum*.<sup>1</sup> Until the anatomical characteristics maintained as distinguishing *Eriophoropsis* are correlated with some leading morphological characters of the inflorescence or the perianth, the plant will scarcely receive general recognition as a unique genus.

With the transfer to *Scirpus* of the two elements, *Eriophorum cyperinum*, L., and its allies, and *Eriophorum alpinum*, L., which made up Persoon's *Trichophorum*, the genus *Eriophorum* becomes one with strongly marked habital characteristics, and with the perianth consisting of numerous elongate flat straight bristles.

#### ERIPHORUM CHAMISSONIS.

The status of the name *Eriophorum Chamissonis* has been the source of much perplexity, and without entering in detail into its history it is impossible to gain a just impression of its significance. On the 9th of November, 1825, Dr. C. A. Meyer presented to the St. Petersburg Academy a paper entitled "*Cyperaceae Novae descriptionibus et iconibus illustratae*," but the paper was not actually printed until 1831.<sup>2</sup> Among the species described was *Eriophorum Chamissonis*<sup>3</sup> based upon "*Erioph. intermedium Cham. in litt.*," not *E. intermedium*, Bastard, clearly described in more than a page of text and beautifully illustrated by a detailed plate. The plant was said to have the "*Habitat in Kamtschatka et Unalaschka, nec non in alpinis Altaicis*," and the very clear plate shows that it is a species well known near the coast of Alaska and Kamtschatka, extending south to Mandschuria, which is generally recognized as identical with the later *E. russeolum*, Fries, of northern Europe. If the name, *E. Chamissonis* were based solely on the description and plate of Meyer, there would be no question as to its merits; but, unfortunately, an Altai plant was also cited; and between the original drafting of the

<sup>1</sup>"*Eriophoropsis virginica* sieht zur Zeit der Fruchtreife einen *Eriophorum* überaus ähnlich . . . Der Bau der Perigonborsten ist der nämliche wie bei *Eriophorum latifolium*."—Palla, l. c. 150.

<sup>2</sup>Mém. Sav. Étrang. Acad. St. Pétersb. i. (1831). <sup>3</sup>l. c. 204, t. 3 (1831).



diagnosis of the species in 1825 and its actual publication in 1831, Ledebour published in his *Flora Altaica*, in 1829, *E. Chamissonis*, ascribing it to Meyer, citing *E. intermedium* of Chamisso's letter and giving almost Meyer's own description of the Unalaskan and Kamtschatkan plant. Ledebour, however, in this first actual publication of *E. Chamissonis*, cited primarily plants from the Altai which subsequently proved to be unlike the Chamisso plant. Thus arose a confusion which has always been troublesome.

The exact identity of the Alati element of *Eriophorum Chamissonis* has been somewhat questionable. By Fries it was apparently taken to be *E. Scheuchzeri* (*E. capitatum*, Host)<sup>1</sup> but by Nylander in his Monograph the Altai element of *E. Chamissonis* is treated as *E. vaginatum*, var. *humile*,<sup>2</sup> the name based upon *E. humile*, Turcz. Bull. Soc. Nat. Mosc. (1838) 103, which was a *nomen nudum*; though by C. B. Clarke<sup>3</sup> *E. vaginatum*, var. *humile*, Nylander, is referred without question to the stoloniferous noncaespitose *E. Scheuchzeri*. A sheet of the original Altai material sent from the Herbarium of the St. Petersburg Academy to the Gray Herbarium and labeled in the characteristic hand of C. A. Meyer "*Eriophorum Chamissonis* C. A. M. *Fl. Alt.*" represents a densely caespitose non-stoloniferous plant closely related to *E. vaginatum* and quite inseparable from the original very clear figure of *E. callitrix*, Chamisso.<sup>4</sup> There can be no question, then, from this authentic material, of the identity of the Altai component of *E. Chamissonis*.

That the name *E. Chamissonis* should be used for the stoloniferous non-caespitose plant of Kamtschatka and Unalaska, obviously the plant collected by Chamisso, which was clearly described and illustrated by Meyer and definitely included by Ledebour in his description, seems open to little question; and in that sense, which was so clearly intended when the name was first put forward and which is indicated by the citation in the *Flora Altaica* of *E. interme-*

<sup>1</sup> "Hoc, nempe *E. Chamissonis* C. A. Meyer, est omnino *E. capitatum* Suecorum." — Fries, Novit. Mant. iii. 170.

<sup>2</sup> *E. vaginatum* var. "*humile* Turcz (= *E. Chamissonis* C. A. M. fl. alt.): culmis caespitosis, vaginis fibrillosis, capitulo subsphaerico, squamis ovato lanceolatis, cinereo-pellucidis. (Siberia altaica etc.)" — Nylander, Acta, Soc. Sc. Fenn. iii. (1852), according to Andersson, Bot. Not. (1857) 58.

<sup>3</sup> Clarke in Hook., Fl. Brit. Ind. vi. 664 (1893).

<sup>4</sup> Chamisso in C. A. Meyer, Mém. Sav. Etrang. Acad. St. Pétersb. i, 203, t. 2 (1831).

*dium*, Chamisso, the name is taken up in this paper. Fries, himself, until he learned that the Altai plant was unlike the Kamtschatka and Unalaska specimens, treated his own *E. russeolum* as a synonym of *E. Chamissonis*, and the same course is followed by Nylander, Richter and some other European students.

#### ERIOPHORUM CALLITRIX.

The name *Eriophorum callitrix* (or *callithrix*) has been taken up by Scandinavian authors<sup>1</sup> for a very slender glabrous plant which in many characters is unlike the original description and plate of Chamisso's species.<sup>2</sup> This original figure represents a plant whose low stoutish habit, short broadish leaves, subinflated upper sheaths, and ovate-lanceolate scales, are all unlike those of the very slender plant represented as *E. callitrix* in Flora Danica,<sup>3</sup> a characteristic species of broad northern range, and by no means rare in the western portions of Canada. Chamisso's description of the leaves, "sub lente margine (apice basique evidentius) tenuissime serrulato-scabra" . . . and "folia fasciculorum sterilius angustiora et evidentius serrulata," is also difficult to reconcile with the almost entirely glabrous (except at the very tip) filiform leaves of the plant long treated by European botanists as *E. callitrix*.

The original plate of *Eriophorum callitrix*, however, very closely matches some northern specimens of the common American representative of *Eriophorum vaginatum*, a plant in which the leaves are usually scabrous on the margins, although the scales are often paler-margined and with more slender tips than represented in the original description and plate. In the latter character, however, the American plant, like the European *E. vaginatum*, is very variable, and many specimens show scales which in color and form are quite inseparable from those of the Chamisso plant.

As already stated in the discussion of *Eriophorum Chamissonis*, the Altai plant included in the original description of that species, and represented in the Gray Herbarium by specimens labeled by

<sup>1</sup> Anders. Bot. Not. (1857) 60; &c.

<sup>2</sup> Cham. in C. A. Meyer, Mém. Sav. Étrang. Acad. St. Pétersb. i 203, t. 2 (1831).

<sup>3</sup> Fl. Dan. Suppl. t. 122 (1874).

Dr. Meyer himself, is the densely caespitose comparatively stout *E. callitrix*, with depressed-globose heads, and the Altai material might easily pass as the basis of the plate accompanying Chamisso's original description.

That *Eriophorum callitrix* (in its original sense) was regarded by Chamisso and Meyer as specifically distinct from *E. vaginatum*, there is no doubt, although the unfortunate mixing of Altai specimens with the very different stoloniferous noncaespitose *E. Chamissonis* created a serious confusion. Nylander in his Monograph<sup>1</sup> recognized the Altai plant as at least varietally separable from *E. vaginatum*, and, judging from their description, Trautvetter and Meyer have since published it anew as *E. brachyantherum*<sup>2</sup> from northeastern Asia.

The slender plant taken by Scandinavian botanists as *Eriophorum callitrix* was first described by Björnström in 1856 as *E. vaginatum*, var. *opacum*, but was soon recognized by all European botanists as a species distinct from *E. vaginatum*, and they have very generally followed the lead of Andersson who supposed it to be Chamisso's *E. callitrix*. This plant (*E. opacum*) has its greatest development in the Canadian Rockies, but it extends eastward to the Great Lakes, and very locally across Arctic Asia to Spitzbergen and Arctic Scandinavia.

GRAY HERBARIUM.

## GYMNOGONGRUS TORREYI (AG.) J. AG.

WILLIAM ALBERT SETCHELL.

CAROLUS AGARDH described, in 1822, in his Species Algarum (p. 254), an alga sent to him from New York by John Torrey, which he named *Sphaerococcus Torreyi*. In 1824, he repeated the description in his Systema Algarum (p. 218) in even briefer form than in the first publication. In 1830, Greville, in his Algae Britannicae (p. LV) referred by synonym the plant, which he may never have

<sup>1</sup> Nylander, Acta Soc. Sc. Fenn. iii. (1852).

<sup>2</sup> Trautv. & Meyer in Middend. Reise, — Fl. Ochot. 98 (1856).



seen, to the genus *Chondrus*, making the binomial, *Chondrus Torreyi*. In 1851, J. G. Agardh, in the second volume of his *Species Algarum* (p. 319), refers the plant of his father to the genus *Gymnogongrus*. The name, *Gymnogongrus Torreyi*, thus given by J. G. Agardh is retained by the species to this day and farther than the information given by the original describer, we have nothing to help us in the definite placing of the plant.

No farther help is given by Kuetzing, who, in his *Species Algarum* (p. 738), simply repeats the description of C. Agardh, and the name has remained one of those which must necessarily be kept in the list of "Species inquirendae." There have been several attempts to unravel the identity of the species, however, but without satisfactory outcome. J. W. Bailey, in an article in the *American Journal of Science* for 1848 (p. 39) says under *Dasya elegans* Ag., "unless I am greatly mistaken, *Sphaerococcus Torreyi* was founded on a battered specimen of this plant" and goes on to say that his reason for expressing this opinion is founded on an examination of a fragment of the original specimen preserved in Dr. Torrey's Herbarium. Harvey, in the second volume of the *Nereis Boreali-Americana* (p. 166) is inclined to refer a fragment received from Hooper, to this species, but without satisfying himself that it really belongs to Agardh's species. J. G. Agardh, in the third volume of the *Species Algarum* (Epicrisis, p. 210), states that the species had never been rediscovered and intimates that certain plants supposed to belong to this species were simply extremely narrow plants of *Gracilaria multipartita* which differ from the type, both in external form and in internal structure. Farlow has nothing to add and says in his *New England Algae* (p. 146) that the species is known only from the description of C. Agardh, which leaves its status in a very undesirable condition.

An examination of the Herbarium of J. G. Agardh in the University at Lund, Sweden, made through the kindness of Dr. Otto Nordstedt, the Curator, has helped the writer toward a solution of the difficulty. The types were readily found and are more plainly marked than some of the types of the species created by C. Agardh. There are six plants included under No. 24119. They are labelled "New York, Torrey, in Hb. C. Agardh," evidently in the handwriting of J. G. Agardh, while in another hand, presumably C. Agardh's, is written "*Sphaerococcus Torreyi*." A careful examination

of one of these plants shows that the compression called for by the description hardly exists. When sections are examined, the compression is so slight that it hardly departs from the cylindrical. In all other respects, color, wiry habit, branching, etc., the plants are so closely resembling *Ahnfeldtia plicata* that the writer feels quite safe in referring them to that species as a robust form, such as is not infrequently met with on the coasts of New England and such as is common on the coasts of the Pacific United States. The color is particularly that characteristic of slightly faded *Ahnfeldtia plicata*. It may be that future workers will divide *Ahnfeldtia plicata* into forms, or even into separate species. Schmitz (Flora, 1893, pp. 393, 394) in fact, voices what is even more than a doubt as to whether the plant of the region of Cape Horn and also the plant of the Ochotsk Sea, are either of them identical with the plant of the North Atlantic. But even the plant of the North Atlantic Coasts varies considerably in coarseness, and there seems to be little other difference to separate them. The internal structure is the same and in this respect the types of *Gymnogongrus Torreyi* agree perfectly with plants of North Atlantic *Ahnfeldtia plicata*.

UNIVERSITY OF CALIFORNIA, Berkeley, Calif.

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AN EXTENSION OF RANGE OF EATONIA PUBESCENS. — *Eatonia pubescens*, Scribner & Merrill, is common on some of the brackish meadows, which lie along the west shore of New Haven harbor, between New Haven and Savin Rock. It is a stout grass, with the lower sheaths and leaves, and also the back of the ligule, softly and densely pubescent. The spikelets are very like those of *E. obtusata*. It is generally in full bloom about the middle of June. I collected it here in 1903, and again in 1904, and usually found it in very wet situations, which could only be reached with comfort at low tide, although it has been described as a plant of dry soil. It was abundant at most of the stations. Mr. Fernald informs me that there is a sheet of this grass in the Gray Herbarium collected by Dr. E. H. Eames on "dry roadside on salt meadows, Fairfield, Conn., June 24, 1902." In the appendix to Britton's Manual, Pennsylvania is given as the northern limit of this essentially southern species, but its occurrence at New Haven and also at Fairfield, twenty miles west of New Haven on Long Island Sound, shows that its range extends at least

into Southern New England. My specimens have been verified at the Gray Herbarium. — R. W. WOODWARD, New Haven, Connecticut.

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SARGENT'S MANUAL OF THE TREES OF NORTH AMERICA. — Any one who has consulted Professor Sargent's *Silva of North America*, or who has had to make shelfroom for it, need not be told of the author's large way of looking at things and of doing things. Over its countless folio pages are spread the details of "the information concerning the trees of North America which has been gathered at the Arnold Arboretum," — that storehouse and headquarters of knowledge of the trees of the world.

Realizing the comparative inaccessibility of the fourteen folio volumes to students of our trees, Professor Sargent has recently put forth a manual<sup>1</sup> in which, as his preface declares, he has tried to bring this information into convenient form. Students everywhere must be grateful for this attempt, but yet their gratitude will not be unmixed with disappointment and dismay. For the manual is as large as many dictionaries, — as big, at least, as a "Webster's Abridged," and its price is — to say the least — inconsiderately high. Compared in size and price with the *Silva*, the manual is, to be sure, Lilliputian, if we may use this term somewhat in a Brobdingnagian sense.

In its rising eight hundred pages there is condensed an enormous amount of information, but at first sight, as compared with the *Silva*, the condensation seems to be due rather to a shrinkage of the pages and of the type than to any sacrifice of words. Of these there is a plenty. Merely the diagnosis of the genus *Crataegus*, for instance, takes between five and six hundred words. Asa Gray in his manual did it in forty-seven, though we must admit that much additional information in regard to this genus has been collected since Gray's time.

Some of the space needed for this over-conscientious completeness is gained by what to the ordinary student is a deplorable omission.

<sup>1</sup> Manual of the Trees of North America (exclusive of Mexico), by Charles Sprague Sargent, with illustrations by Charles Edward Faxon. Boston and New York, Houghton, Mifflin and Company, 1905, pp. 826. Price \$6.00 net.



Who but a professional botanist, or one of the new school as regards nomenclature, will be able to recognize even common trees in the absence of synonymy? Even if we may admit that students fortunate enough to pursue their studies in the grounds of the Arnold Arboretum will not be disconcerted, in the presence of the familiar tree, to see *Carya alba* labeled *Hicoria ovata*, can we suppose that more than one student in a hundred, looking for the description of *Ulmus racemosa* will, even after some diligence, recognize it as *Ulmus Thomasi*?

But perhaps these remarks are beside the point. The question is, what will the student find in the book? The minutest, fullest details as to the characteristics in trunk, in branch, in twig, in leaf, in flower, in fruit, of every tree hitherto observed in all the length and breadth of North America, exclusive of Mexico; an account also of its climatal and geographical range; and last and best pen drawings to the number of six hundred and forty-four by the accurate hand of Charles Edward Faxon. "In them," as the author says, and we are inclined to agree with him, "will be found the chief value of this manual."

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POLYGONUM EXSERTUM IN MASSACHUSETTS. — *Polygonum exsertum* Small has been collected several times along the Charles River in Boston, Massachusetts, associated with *Aster subulatus* Michx. After frost this species is rendered somewhat conspicuous by the reddening of the foliage and sepals. Where it grows in dry soil it is reduced in size and has smaller fruit. Mature achenes from a plant less than a foot high were only three millimeters long. Specimens examined: *A. S. Pease*, no. 482, Sept. 27, 1900, (Hb. Pease); *A. H. Moore*, no. 1539, Nov. 10, 1903, (Hb. Moore); *H. H. Bartlett*, Oct. 26, 1904, (Gray Hb. and Hb. Bartlett).—H. H. BARTLETT, Cambridge, Massachusetts.

*Vol. 7, no. 78, including pages 101 to 120 and plate 61, was issued 1 June, 1905.*

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